Tidal Chickahominy River System
Supplemental Stocking Project

Report – Year 3

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Background

Drought conditions persisted regionally from the mid-1990's through late 2002. During which time, largemouth populations in the Chickahominy and other tidal rivers experienced a protracted period of recruitment failure which eventually resulted in reduced angler catches. With improved recruitment, tidal river bass populations rebounded rapidly in the years following the drought. In the case of the tidal Chickahominy, improvements in recruitment were dramatic (Figure 1), and angler catch rates almost doubled between 2002 and 2005 – as determined by seasonal angler surveys (Figure 2).

The current project was undertaken in an effort to determine if supplemental stocking of fingerling largemouth can be effective in tidal river systems. If supplemental stocking were found to be a viable option, fisheries managers would have a mechanism for augmenting weak year-classes during future periods of recurrent recruitment failure – resulting in more stable bass fisheries in these highly dynamic systems.

Oxytetracycline (OTC) marked F_1 (Florida X northern) fingerling largemouth were stocked at a rate of 62 fish/ha (25 fish/ac) in the tidal Chickahominy River system for three consecutive years during the period 2005 – 2007. With this system estimated to be 1,856 ha (4,586 ac), 114,000 fingerlings were targeted for stocking each year. Stocking success was evaluated based on two parameters: contribution to year-class strength and boat electrofishing catch per effort (CPE). Given annual boat electrofishing surveys were already scheduled for October-November in this system, sampling events for this project were set to coincide with these surveys. The 2005 – 2007 year-classes to be sampled at age-0+, age-1+, and age-2+. In addition, to assess over-winter survival of the previous year's stocked fish, targeted electrofishing was scheduled for April 2006 – 2008. All sampling to occur at sites previously selected for fixed station fall electrofishing surveys (Figure 3).

In 2007, VDGIF biologists entered into year-3 of the project, activities included the third and final year of stocking and assessments of the three stocking events.

Assessment of 2005 Stocking

In October-November 2007, approximately 28 months post-stocking, Virginia Department of Game and Inland Fisheries (VDGIF) fisheries biologists conducted their annual boat electrofishing survey of the tidal Chickahominy, sampling 16 stations and expending a total of 4.4 hours of boat electrofishing effort.

A random sample of adult largemouth (n = 253) was aged and otoliths were checked for the presence OTC marks. Stocked fish were caught at a rate of 2 fish/hr, and accounted for 11.4% of the 71 age-2+ (2005 year-class) largemouth sampled (Table 1). Stocked fish were not significantly larger than natural-spawn age-2+ fish (Figure 4); mean total length (TL) of stocked fish was 357 cm (14.0 inches) and mean total length of natural-spawn fish was 340 cm (13.4 inches).

Assessment of 2006 Stocking

In April 2007, approximately 10½ months post-stocking, VDGIF fisheries biologists conducted a boat electrofishing survey targeting 2006 year-class largemouth bass, sampling 15 stations (Figure 3) and expending a total of 3.8 hours of boat electrofishing effort. Given expected growth of largemouth in the tidal Chickahominy, only largemouth smaller than 28 cm (11.0 inches) were collected. Ages were determined and otoliths were checked for the presence of OTC marks. All largemouth in the sample 26 cm (10 inches) and larger were older fish (not 2006 YC fish). Of the 107 fish sampled from the 2006 year-class, 75% were stocked fish (Table 2). Stocked fish (mean TL = 205 mm (8.1 inches)) were significantly larger than natural-spawn fish (mean TL = 148 mm (5.8 inches)) (Figure 5) – Mann-Whitney Rank Sum Test ($p < 0.001$).

Approximately 17 months after the June 2006 stocking, a check of OTC marks on otoliths from a random sub-sample (n = 114) of age-1+ fish collected by boat electrofishing indicated that 74% of the 2006 year-class sampled were stocked fish (Table 2). Total catch per effort (CPE) of 2005 year-class largemouth was 31 fish/hr. With $CPE_{(stocked)}$ = 23 fish/hour and $CPE_{(natural\text{-}spawn)}$ = 8 fish/hour. Although stocked fish collected during the survey were significantly larger than natural-spawn fish (mean $TL_{(stocked)}$ = 320 mm (12.6 in) and mean $TL_{(natural\text{-}spawn)}$ = 273 mm (10.7 in)), the size difference between stocked and natural-spawn fish was unchanged from October 2006 (Figure 6). That is, stocked fish had not out performed natural-spawn fish in terms of growth in the interim between October 2006 and October 2007.

2007 Stocking Event

On May 24th, an estimated 114,500 OTC-marked fingerling largemouth were delivered to Chickahominy Riverfront Park. On arrival, the fish were in excellent condition and of uniform size, having a mean total length of 54 mm (~2 inches). As in 2006, fingerlings were distributed by VDGIF boats to stocking sites (Figure 7) located along the margins of submerged or emergent aquatic vegetation. All boats were equipped with 570 - 760 l (150

- 200 gal) water tanks supplied with a continuous flow of oxygen through diffuser stones. The volume of these tanks allowed direct transfer of fingerlings from the hatchery truck to boats – no netting and open air transfer.

Initial Assessment of 2007 Stocking

Young-of-year (YOY) bass were first sampled at approximately 5 months post-stocking, during the October-November 2007 electrofishing survey described above. Sample locations did not necessarily coincide with stocking locations.

A check of OTC marks on a sub-sample of YOY (n = 118) indicated that stocked fish accounted for 66% of the year-class. Total CPE of YOY largemouth was 41 fish/hr, with $CPE_{(stocked)}$ = 27 fish/hour and $CPE_{(natural\text{-}spawn)}$ = 14 fish/hour.

Stocked YOY bass were significantly larger than natural-spawn YOY, with mean $TL_{(stocked)}$ = 211 mm (8.3 inches) and mean $TL_{(natural\text{-}spawn)}$ = 150 mm (5.9 inches) respectively (Figure 8).

Discussion

Although initial mortality rates were apparently quite high for the 2005 cohort of stocked fish, at two-plus years post-stocking, these fish have persisted in the system at low relative abundance levels, with consistent contribution of stocked fish to the 2005 year-class (Table 1).

The 2006 cohort has also persisted, and as opposed to the 2005 cohort, returns of the 2006 cohort of stocked fish have been outstanding – with consistent contribution of stocked fish to the year-class and robust catch rates (Table 2). As a result, rather than a fair-to-average year-class, the combined (stocked and natural-spawn) year-class was unusually strong – these fish have recruited to the adult population, and the fishery.

As with the 2006 cohort, catches of YOY from the 2007 cohort of stocked fish were outstanding. While this will likely be an average year-class for Chickahominy-spawned largemouth, assuming minimal compensatory mortality, the combined (stocked and natural-spawn) 2007 year-class has the potential to be strong. A more complete picture will be available when these fish have been tracked for two years.

In 2006 and 2007, stocked fish were significantly larger than natural-spawn fish as YOY sampled in the fall. The size differential may not be due to differences in growth rates (stocked v. natural-spawn), but rather a function of an early stocking date – stocked fish getting a jump start on growth. The 2006-stocked fish did not increase their size differential over natural-spawn fish between October 2006 and October 2007. The 2005 fish, stocked six weeks later than those in 2006 and 2007, were not significantly larger than natural-spawn fish as YOY, and have not grown significantly faster in the time since.

Results to date indicate supplemental stocking has potential as a fisheries management tool for our tidal rivers. Initial returns from the 2006 and 2007 stocking events were outstanding, and good survival of these fish through age-2+ will provide strong evidence that supplemental stocking can produce strong year-classes from fair-to-average year-classes in the tidal Chickahominy. However, it remains undetermined whether supplemental stocking will be successful when recruitment failure is occurring in the system – recruitment failure did not occur in the population during this study. And, the question remains as to whether the results observed in this system can be replicated elsewhere.

At this point, there is no evidence the F_1 fish are out performing (in terms of growth) Chickahominy-spawned fish. Unless F_1 fish out perform Chickahominy-spawned fish at older ages (beyond age-2+), there is no apparent advantage to stocking F_1 fingerlings, and the use of broodstock collected from the Chickahominy would be the obvious choice in future stocking efforts.

Funding Acknowledgements

In addition to resources put forward by VDGIF under Sport Fish Restoration projects F-111-R and F-109-D, several organizations have contributed funds to this project, they include: Concerned Bass Anglers of Virginia, Bass Pro Shops, and FishAmerica Foundation/FLW Outdoors.

Table 1. Summary of the percent contribution of OTC-marked fish to the 2005 year-class, and catch per effort (CPE) of stocked, natural-spawn, and total 2005 year-class fish sampled. The number of 2005 year-class fish (stocked and total) sampled in parentheses.

	Percent	CPE (fish/hr)		
Sample Date	**Stocked Fish**	**Stocked**	**Natural**	**Total**
October 2005	**8.2%** (8 of 97)	**2.0**	**22.6**	**24.6**
April 2006	**9.9%** (14 of 142)	**3.0**	**27.3**	**30.2**
October 2006	**19.2%** (15 of 78)	**9.5**	**39.8**	**49.3**
October 2007	**11.4%** (8 of 70)	**2.2**	**17.5**	**19.7**

Table 2. Summary of the percent contribution of OTC-marked fish to the 2006 year-class, and catch per effort (CPE) of stocked, natural-spawn, and total 2006 year-class fish sampled. The number of 2006 year-class fish (stocked and total) sampled in parentheses.

	Percent	CPE (fish/hr)		
Sample Date	**Stocked Fish**	**Stocked**	**Natural**	**Total**
October 2006	**78.6%** (158 of 201)	**35.6**	**9.7**	**45.2**
April 2007	**74.8%** (80 of 107)	**23.0**	**7.8**	**30.8**
October 2007	**73.7%** (84 of 114)	**22.9**	**8.2**	**31.1**

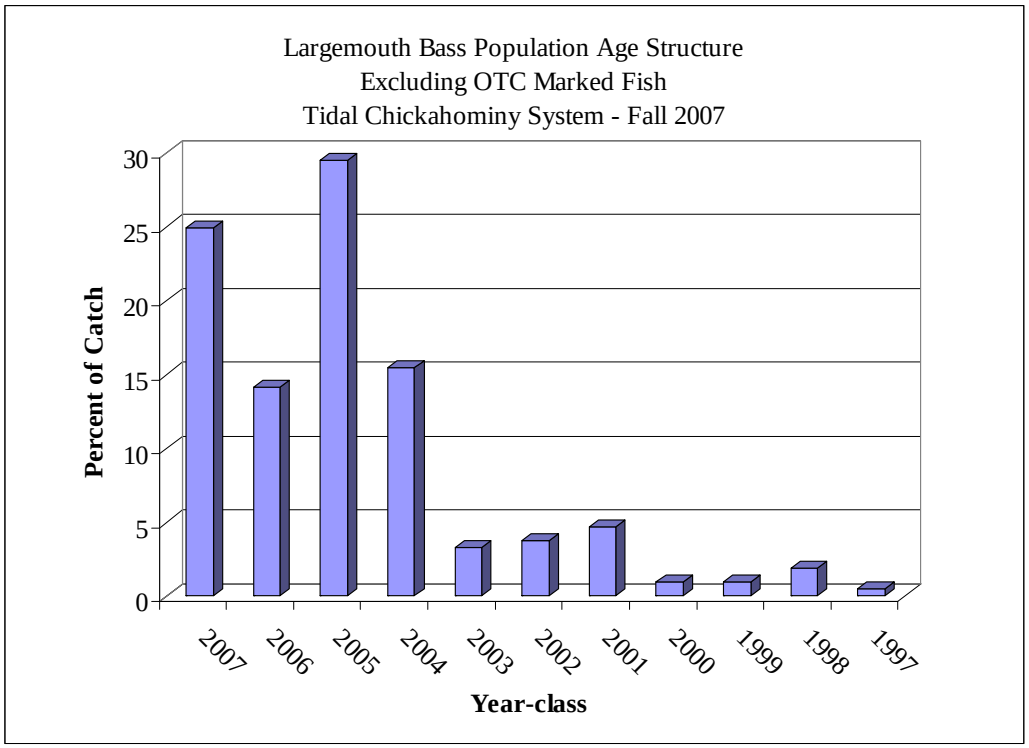

Figure 1. Age distribution of largemouth bass (natural-spawn only) sampled during a boat electrofishing survey conducted in the tidal Chickahominy River system in October-November 2007.

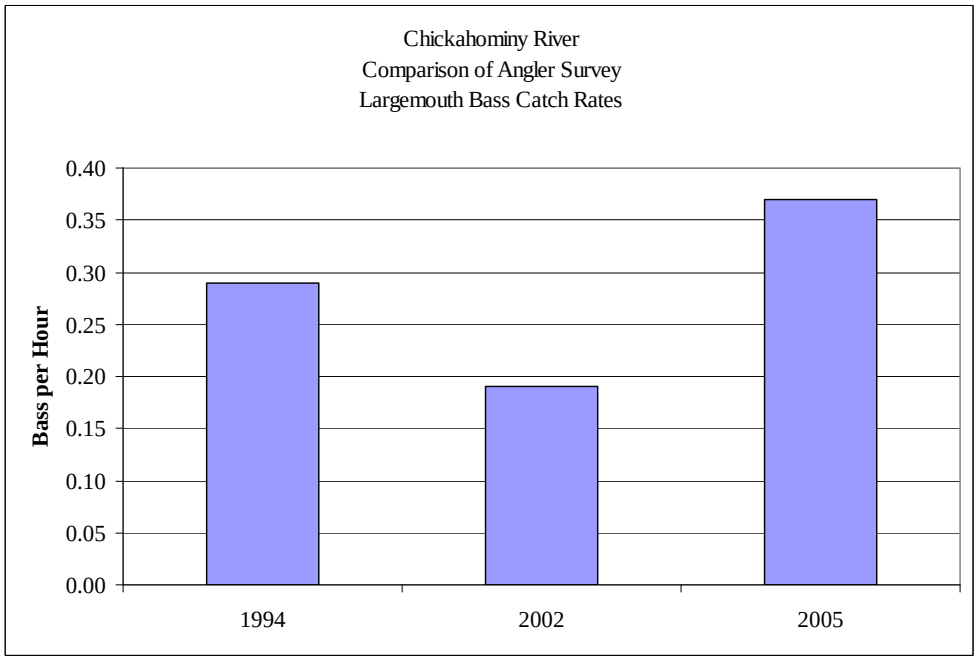

Figure 2. Comparison of angler catch rates (bass/hour) during May – October, as determined by angler surveys conducted in 1994, 2002, and 2005.

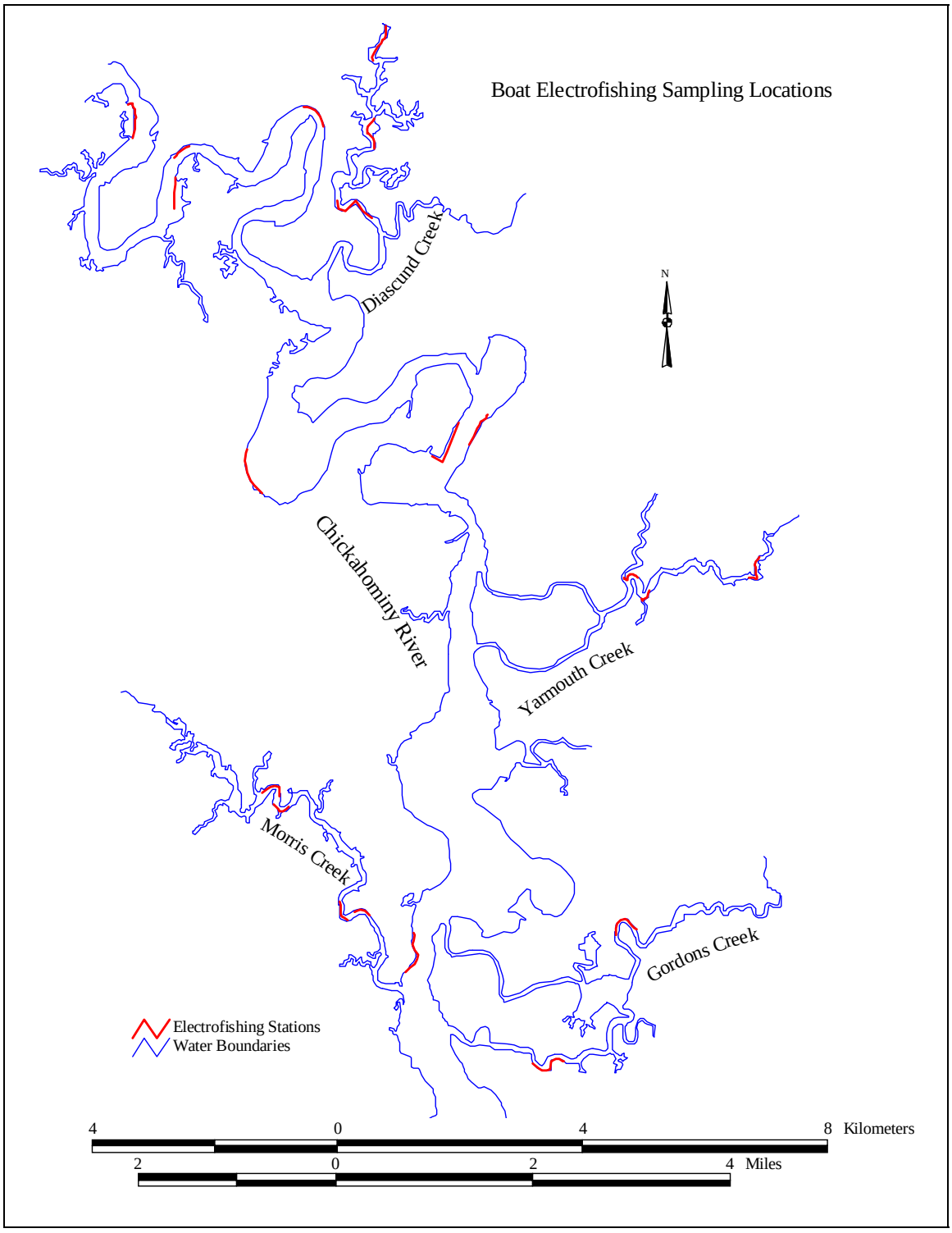

Figure 3. Distribution of sites sampled during boat electrofishing.

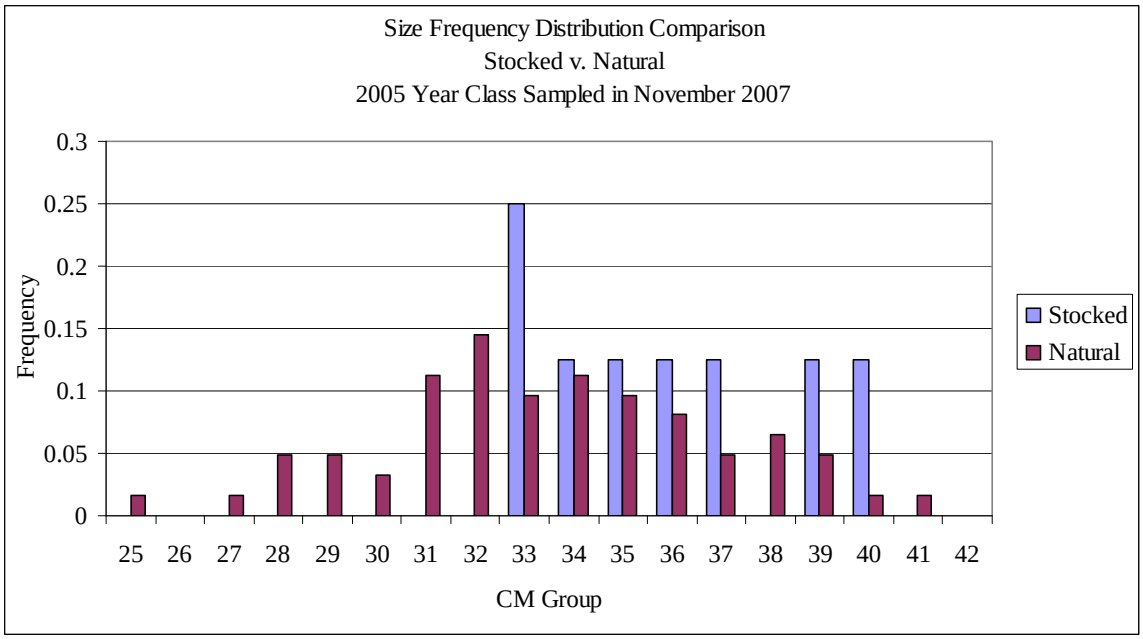

Figure 4. Comparison of the size distribution of stocked and natural-spawn age-2+ (2005 year-class) largemouth collected during boat electrofishing of the tidal Chickahominy River system in October-November 2007.

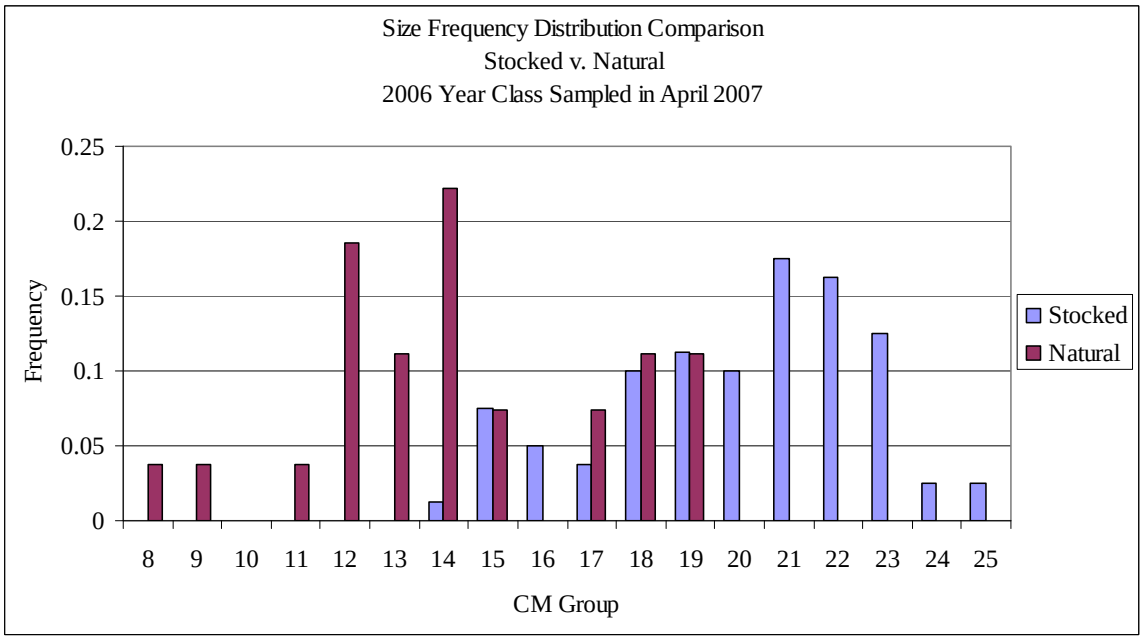

Figure 5. Comparison of the size distribution of stocked and natural-spawn age-1+ (2006 year-class) largemouth collected during boat electrofishing of the tidal Chickahominy River system in April 2007. Stocked fish were significantly bigger than natural-spawn fish – Mann-Whitney Rank Sum test ($p<0.001$).

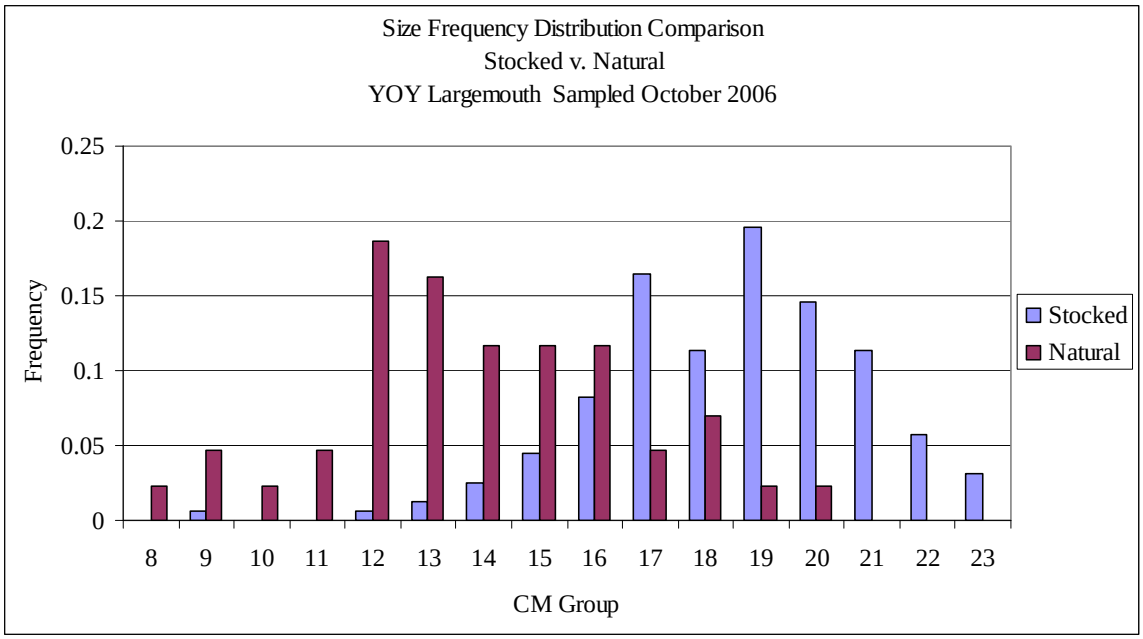

Figure 6a. Comparison of the size distribution of stocked and natural-spawn age-0+ (2006 year-class) largemouth collected in October 2006. Stocked fish were significantly larger than natural-spawn fish – t-test difference 46 mm; 95% C.I. (38 – 55 mm); $p<0.001$.

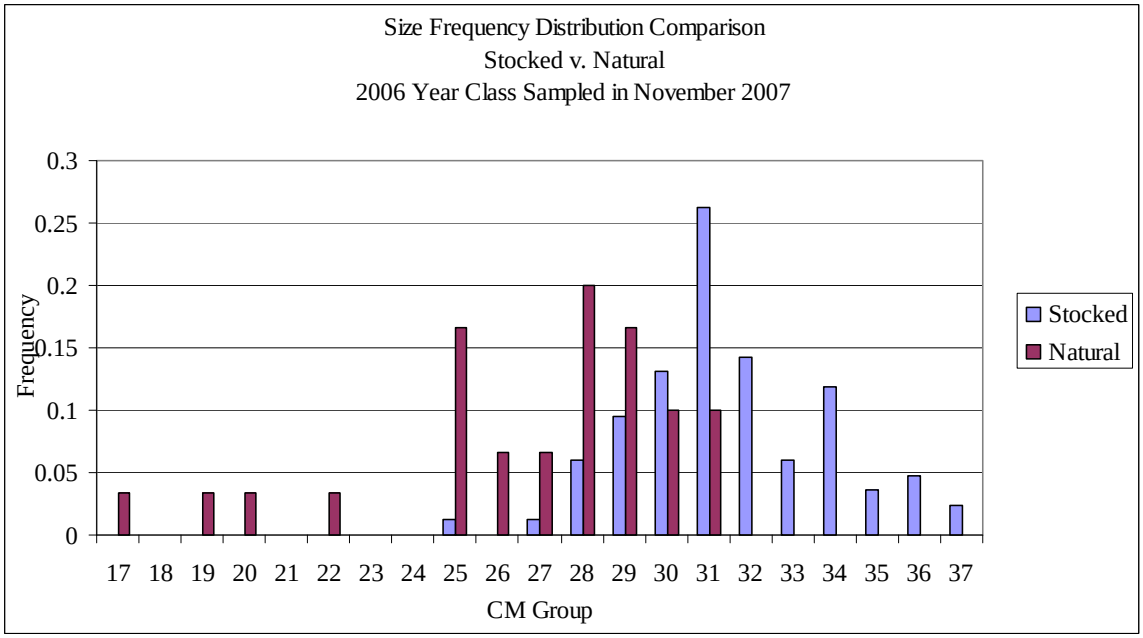

Figure 6b. Comparison of the size distribution of stocked and natural-spawn age-1+ (2006 year-class) largemouth collected from the tidal Chickahominy River system in October-November 2007. Stocked fish were significantly larger than natural-spawn fish – t-test difference 47 mm; 95% C.I. (36 – 59 mm); $p<0.001$.

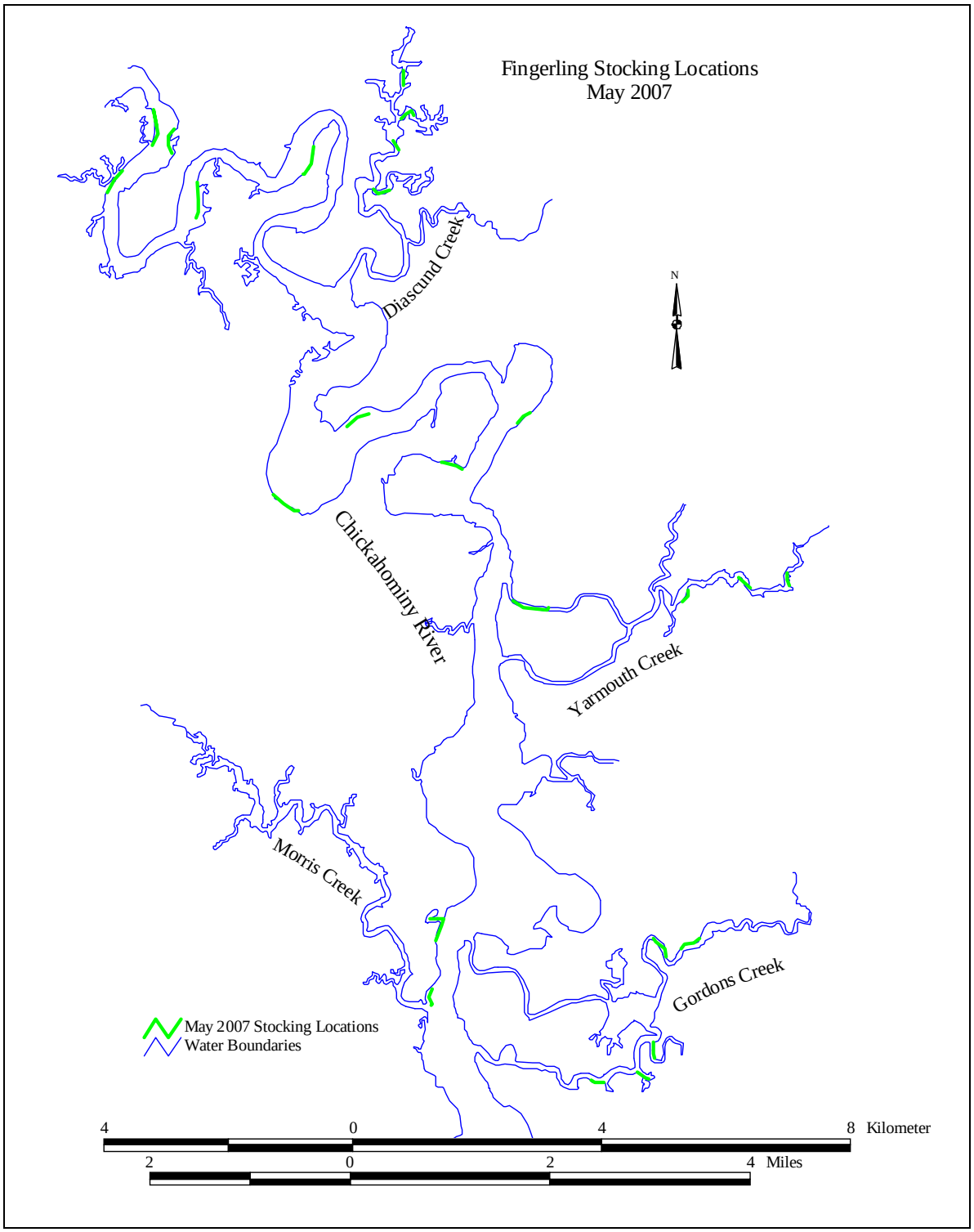

Figure 7. Distribution of May 24, 2007 fingerling stocking locations in the tidal Chickahominy River system.

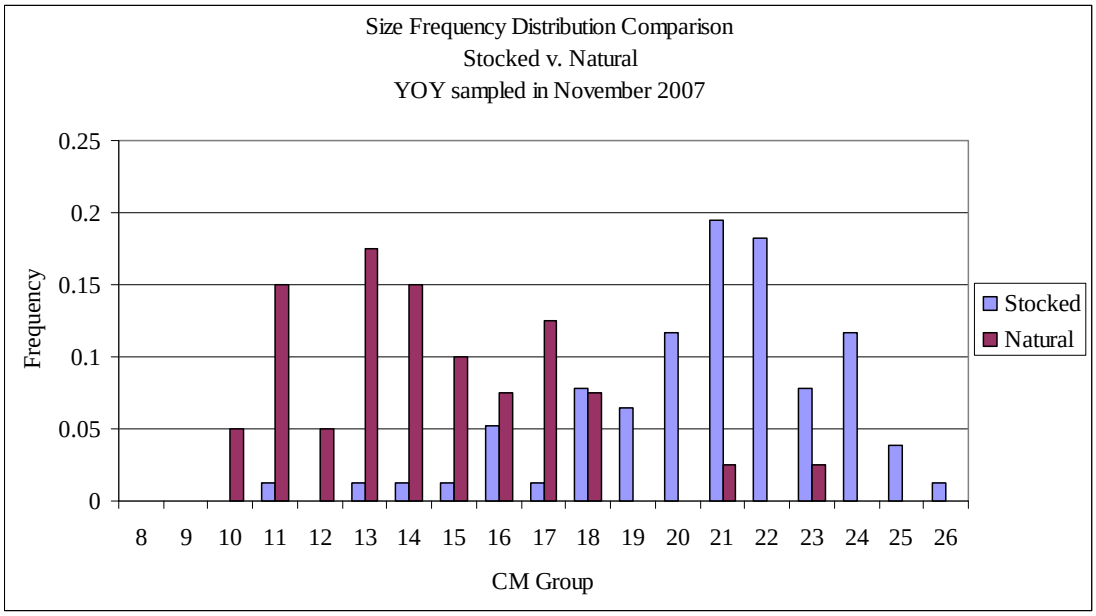

Figure 8. Comparison of the size distribution of stocked, and naturally spawned young-of-year largemouth collected during boat electrofishing of the tidal Chickahominy River system in October-November 2007. Stocked fish were significantly larger than natural-spawn fish – t-test difference 62 mm; 95% C.I. (51 – 73 mm); $p<0.001$.